UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/792,073	03/03/2004	Hui Cheng	SAR 14754	4205

31908 7590 02/27/2007
MENDELSOHN & ASSOCIATES, P.C.
1500 JOHN F. KENNEDY BLVD., SUITE 405
PHILADELPHIA, PA 19102

EXAMINER	
RADKIEWICZ, JARED	
ART UNIT	PAPER NUMBER
2609	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/27/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/792,073	CHENG, HUI	
	Examiner	Art Unit	
	Jared W. Radkiewicz	2609	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,7-18 and 21-27* is/are rejected.

7)☒ Claim(s) *6, 15, 19, 20* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *3/21/2005, 4/19/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claims 10-12 are objected to under 37 C.F.R 1.75(d) because of the following informalities: the term "processed video stream" lacks antecedent basis. For the purposes of examination the phrase will be interpreted as "processed video sequence". Appropriate correction is required.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

2. Claims 1-5, 7-13, 15-18 and 23-25 are rejected under 35 U.S.C. 102(a) as being anticipated by Caspi et al. ("Spatio-Temporal Alignment of Sequences", Y. Caspi and M. Irani, IEEE Trans. on Pattern Analysis and Machine Intelligence, Vol. 24 No. 11, pp. 1409-1424, November 2002).

Regarding claim 1, Caspi discloses a method for identifying correspondence between an original video sequence comprising a plurality of original frames and a processed video sequence comprising a plurality of processed frames (Caspi's system "establishes correspondences both in time

and in space between multiple sequences"; Section 1 Page 1), the method comprising:

dividing the processed video sequence into a plurality of processed sets, each processed set having one or more processed frames (Caspi evaluates individual space-time points in each sequence, evaluating each frame of the second sequence individually; Section 2 Page 3);

identifying, for each processed set, one or more original sets from the original video sequence, wherein each original set comprises one or more original frames (Caspi's spatio-temporal misalignment **P** is defined between two space-time points, **x** and **x'**, each point necessarily belonging to a single frame in the reference sequence *S* and the second sequence *S'*, respectively; Section 2 Page3);

and two or more original sets are identified for at least one processed set (In the minimization of error function (4) a single space-time point **x** and associated frame in *S* is compared to *all* space-time points **x'** and associated frames in S'; Section 3.2 Page 8);

generating a mapping for each original set corresponding to each processed set, wherein the mapping defines, for the original set, a mapped set that approximates the corresponding processed set (the parametric model **P** defines the misalignment between *S* and *S'*; Section 2 Page 3); and

the mapping minimizes a local prediction error between the mapped set and the corresponding processed set; and selecting, for each processed set, the original set whose mapping minimizes an accumulated prediction error for the

processed video sequence (Equations (4) and (5) minimize prediction error **P** between sequences, with **P** consisting individual displacements **u** between frames; Section 3.2 Page 8).

Regarding claim 2, Caspi further discloses the method as detailed above wherein each original set consists of one or two original frames; each mapped set consists of a single mapped frame; and each processed set consists of a single processed frame (Caspi relates a single frame in the reference sequence to one in the second sequence via space-time points; Section 2 Page 3).

Regarding claim 3, Caspi further discloses the method as detailed above wherein generating each mapping involves temporal registration (Caspi calculates a "spatio-temporal displacement **u**", comprising a temporal portion used to align the two sequences; Section 2 Page 3).

Regarding claim 4, Caspi further discloses the method as detailed above wherein generating each mapping involves at least one of spatial registration and histogram registration (Caspi calculates a "spatio-temporal displacement **u**", comprising a spatial portion used to align the two sequences; Section 2 Page 3).

Regarding claim 5, Caspi teaches the invention of claim 4, wherein generating each mapping involves spatial registration (Caspi calculates a "spatio-temporal displacement **u**", comprising a spatial portion used to align the two

sequences; Section 2 Page 3) and histogram registration (Caspi recovers "spatial and temporal alignment parameters between the two sequences directly from sequence brightness variations", where the histogram is a representation of image brightness; Section 3.2 Page 8).

Regarding claim 7, Caspi teaches the invention claimed in 3 wherein the temporal registration involves minimizing the local prediction error between a weighted sum of two original frames and a corresponding processed frame ("Sequence-to-sequence alignment, on the other hand is not restricted to physical ("integer") image frames."; Section 4.1(ii) Page 15).

Regarding claim 8, Caspi teaches the invention of claim 1, wherein one or more constraints are applied to limit the number of different original sets that are identified for each processed set (the "outlier rejection mechanism", Section 3.1 Page 7 Paragraph 2, in step 5 of the algorithm detailed in Section 3.1 Page 5).

Regarding claim 9, Caspi teaches the invention of claim 8, wherein at least one constraint is a causal constraint that specifies that no original frames displayed in the past can be used to generate a current processed frame (The feature based alignment algorithm detailed in section 3.1 utilizes "feature trajectories", which can "uniquely define: (i) the spatial transform, (ii) the temporal transform". All trajectories of real objects obey causality, and the "outlier

rejection mechanism" of step 5 would remove any non-causal hypothesis from consideration; Section 3.1 Page 5).

Regarding claim 10, Caspi teaches the invention of claim 1 wherein a first selected original set corresponds to the first processed frame in the processed video sequence; and each other selected original set for each other processed frame depends on a selected original set corresponding to a previous processed frame (The interpretation of "first processed frame" will be taken as the first frame in a chosen subsequence of the processed set, not necessarily the first frame of the entire processed set. Under this interpretation, the feature based sequence alignment method of 3.1 using feature trajectories aligns two video sequences via causal trajectory information. The alignment is based on causal information, such that all points chosen after a given point depend on it, i.e. when constructing feature trajectories the method will "detect and track feature points" where tracking indicates some predictive aspect of following a point, Section 3.1 Page 5).

Regarding claim 11, Caspi teaches the invention of claim 10, wherein the dependence between selected original sets is based on one or more constraints (the "threshold" of step (5) of the algorithm, Section 3.1 Page 5).

Regarding claim 12, Caspi teaches the invention of claim 11, wherein at least one constraint is a causal constraint that specifies that no original frames

displayed in the past can be used to generate a current processed frame (Using the same grounds for rejection as claim 9, the feature based alignment algorithm detailed in section 3.1 utilizes "feature trajectories", which can "uniquely define: (i) the spatial transform, (ii) the temporal transform". All trajectories of real objects obey causality, and the "outlier rejection mechanism" of step 5 would remove any non-causal hypothesis from consideration; Section 3.1 Page 5).

Regarding claim 13, Caspi teaches the method of claim 1 wherein at least one original frame is not included in any mapping ("*Temporal misalignment* results when the two input sequences have a time-shift (offset) between them", where any video portion not common to both sequences would not be included in any mapping; Section 2 Page 3).

Regarding claim 16, Caspi teaches the invention of claim 1, wherein the local prediction error between each mapped set and the corresponding processed set is a function of a matching term and a context term (The algorithm laid out in steps (1)-(8) in Section 3.1 Page 5-6 identifies both elements shown below);

the matching term characterizes differences between the mapped set and the corresponding processed set (Equation (1) calculates the displacement error function between both sets and is used in (7) of the algorithm, Section 3.1 Page 6); and

the context term corresponds to a cost associated with one or more contextual constraints applied to a temporal relationship between the original and processed video sequences ("a single pair of corresponding trajectories can uniquely define ... the temporal transformation" Caspi Section 3.1 Page 5).

Regarding claim 17, Caspi teaches the invention of claim 16, wherein the matching term corresponds to a mean squared error between the mapped set and the corresponding processed set (Equation (1) calculates the displacement error function between both sets using the sum of squared errors, Section 3.1 Page 6).

Regarding claim 18, Caspi teaches the invention of claim 16, wherein the context term enforces a causal constraint that no previously displayed frames can be subsequently processed (The "feature trajectories" of real objects obey causality; Section 3.1 Page 5).

Regarding claim 23, Caspi teaches the invention claimed in 1 further comprising the step of adjusting the processed video sequence to correct for one or more misalignments between the original and processed video sequences (Caspi's system aligns two sequences in Figure 4 Page 10).

Regarding claim 24, Caspi teaches the invention of claim 23, wherein the one or more misalignments include at least one of spatial misalignment and

histogram misalignment (Caspi's system aligns two sequences in the spatial domain in Figure 4 Page 10).

Regarding claim 25, Caspi teaches claim 24 wherein the one or more misalignments include both spatial misalignment (Caspi's system aligns two sequences in the spatial domain in Figure 4 Page 10) and histogram misalignment (And uses image brightness (histogram) matching in Figure 8 Page 14).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Caspi et al. ("Spatio-Temporal Alignment of Sequences", Y. Caspi and M. Irani, IEEE Trans. on Pattern Analysis and Machine Intelligence, Vol. 24 No. 11, pp. 1409-1424, November 2002) and Claus et al. (US 4,786,979).

Regarding claim 14, Caspi teaches the method of claim 1.

Caspi does not teach the method wherein one processed frame is a repetition of the immediately preceding processed frame.

Claus teaches an exemplary system of video processing that introduces a sequentially duplicate frame (Claus Fig. 1).

It would have been obvious at the time of the invention to one of ordinary skill in the art to use the processing method of Claus as the means to create the processed sequence in Caspi because the method taught by Claus is pervasive in the art of video processing ("Currently, the most popular method of converting 24 frames per second (fps) film to 60 fields/s video is to repeat each odd-numbered frame for 3 fields and each even-numbered frame for 2 fields", Introduction Hilman et al. ("Using Motion-Compensated Frame-Rate Conversion for the Correction of 3:2 Pulldown Artifacts in Video Sequences", Hilman et al., IEEE Trans. On circuits and systems for video technology, Vol. 10, No.6, pp. 869-877, September 2000))

5. Claim 21 rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Delannay et al. ("Compensation of Geometrical Deformations for Watermark Extraction in the Digital Cinema Application", Delannay et al., SPIE Security and Watermarking of Multimedia Contents III, Vol. 4314, pp. 149-157, August 2001) and Caspi et al. ("Spatio-Temporal Alignment of Sequences", Y. Caspi and M. Irani, IEEE Trans. on Pattern Analysis and Machine Intelligence, Vol. 24 No. 11, pp. 1409-1424, November 2002).

Regarding claim 21, Delannay teaches the method of processing a video sequence, wherein the video sequence has been generated by capturing with a camcorder a display of the original video sequence ("a spectator filming the

projected movie with a handy cam at the back of the theatre." Delannay Section 2.1 Page 150).

Delannay does not teach the method of claim 1.

Caspi teaches all elements of the method of claim 1.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide the method of Delannay with the spatio-temporal alignment of Caspi to ensure proper watermark extraction. Delannay uses a watermark extraction technique that is done "with the help of the unmodified content" (Delannay Section 3 Page 153). Furthermore, Delannay tries to "obtain a image very close to the original" (Delannay Section 3 Page 153) in order to recover the watermark features because the system relies on matching features between the original and unprocessed video sequences. Caspi's system is an extension of that same principle, and could be employed in Delaney's system to obtain an image sequence closer to the original to properly recover a watermark from a video sequence.

6. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Schumann et al. (US 6,285,774 B1) and Caspi et al. ("Spatio-Temporal Alignment of Sequences", Y. Caspi and M. Irani, IEEE Trans. on Pattern Analysis and Machine Intelligence, Vol. 24 No. 11, pp. 1409-1424, November 2002).

Regarding claim 22, Schumann teaches identifying a watermark in an original frame; and determining whether a corresponding processed frame has a

similar watermark (Mark extraction system 122 Fig. 1, where the processed frame is derived from the unauthorized copy 138 Fig.1).

Schumann does not teach the method of claim 1.

Caspi teaches all elements of claim 1, as detailed above.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide the system of Schumann with the spatio-temporal registration method of Caspi to overcome any misalignment between the unauthorized copy and the original copy of the movie to improve accuracy of the mark extraction system. Delannay et al. ("Compensation of Geometrical Deformations for Watermark Extraction in the Digital Cinema Application", Delannay et al., SPIE Security and Watermarking of Multimedia Contents III, Vol. 4314, pp. 149-157, August 2001) tries to "obtain a image very close to the original" (Delannay Section 3 Page 153) in order to recover watermark features. Caspi's system is an extension of that same principle, and could be used to match a reference sequence to a processed sequence in Schumann's invention to recover a watermark.

Claims 26 and 27 are rejected under 35 U.S.C. 203(a) as being unpatentable over the combination of Caspi et al. ("Spatio-Temporal Alignment of Sequences", Y. Caspi and M. Irani, IEEE Trans. on Pattern Analysis and Machine Intelligence, Vol. 24 No. 11, pp. 1409-1424, November 2002) and Caspi et al. (US 2002/0094135 A1).

Regarding claim 26, Caspi IEEE teaches the method of claim 1.

Caspi IEEE does not teach a machine-readable medium, having encoded thereon program code, wherein, when the program code is executed by a machine, the machine implements the method of claim 1.

Caspi '135 teaches a "preferred software embodiment" (Caspi '135 Paragraph [0176]) to implement a video alignment algorithm.

It would have been obvious at the time of invention to one of ordinary skill in the art to provide the method of Caspi IEEE with the software embodiment of Caspi '135 in order to execute the method on digital data using a general-purpose computer.

Regarding claim 27, Caspi IEEE teaches the method of claim 1.

Caspi IEEE does not teach an apparatus with means for executing the method of claim 1.

Caspi '135 teaches a "Silicon Graphics computer" (Caspi '135 Paragraph [0176]) being configured to execute a method of video alignment.

It would have been obvious at the time of invention to one of ordinary skill in the art to provide the method of Caspi IEEE with the apparatus embodiment of Caspi '135 to have a way to execute the video registration method and to provide user interaction to the method.

Allowable Subject Matter

7. Claims 6, 15, 19, and 20 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claim 6, the most pertinent prior art is Caspi et al. as cited above. Although Caspi does teach each of temporal, spatial, and histogram registration independently; Caspi does not teach a method of using all three in the same embodiment and iteratively fixing two while optimizing the third.

Regarding claim 15, the most pertinent prior art is Caspi et al. as cited above. Caspi teaches a causal constraint placed on the matching function, however this constraint is not a monotonically increasing function nor does it increase from a selected frame with the largest index.

Regarding claim 19, the most pertinent prior art is Caspi et al. While Caspi teaches a local prediction error comprising two terms, Caspi does not teach penalizing repetition and dropping of original frames.

Regarding claim 20, the most pertinent prior art is again Caspi et al. Caspi teaches a causal constraint placed on the matching function, however this constraint is not a monotonically increasing function nor does it increase from a selected frame with the largest index.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Hu (US 6,259,477 B1) teaches a system for aligning video

sequences in the spatial and temporal domains for the purposes of fidelity comparison between a reference and processed sequence. Hu uses a less robust method of spatio-temporal alignment than applicant that relies exclusively on scene transitions. Similarly, Overton (US 5,894,324) teaches the method of aligning two video sequences using partial picture, again an approach not nearly as robust as applicant's own. Joly (US 7,043,684 B2) discloses a method for synchronization of arbitrary data streams with the same content, with one being processed. Joly discloses a robust temporal alignment method but does not teach a complete spatial alignment method. Lastly, Caspi ("Alignment of non-overlapping sequences", Caspi et al., IEEE Eighth International conference on Computer Vision, Vol. 2, pp. 76-83, July 2001) is an earlier version of the Caspi paper referenced above, and could have been used in replacement of the later version for most purposes.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jared W. Radkiewicz whose telephone number is (571) 270-1577. The examiner can normally be reached on 8:00 - 5:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian P. Werner can be reached on (571) 272-7401. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JWR

BRIAN WERNER
SUPERVISORY PATENT EXAMINER